

Performance in kimono grip strength tests among Brazilian Jiu-Jitsu practitioners from different levels

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Summary

Introduction. In combat sports involving grappling, muscular strength is considered one of the most important physical components to be developed, specifically in upper limbs. The objective of our study was to examine if there are differences between elite and non-elite Brazilian Jiu-Jitsu practitioners, in two kimono grip strength endurance tests.

Material and methods. Forty Brazilian Jiu-Jitsu practitioners were divided in four groups: Advanced; Non-Advanced; Recreational and Beginners. All participants performed the kimono grip pull-up tests, both maximum static lift and maximum number of repetitions, until maximal volunteer fatigue with appropriated interval. A One Way analysis of variance was used to compare the groups. Tukey test was used as post hoc test.

Results. There were no difference in maximum static lift and maximum number of repetitions tests between Advanced (18 ± 3 rep; 62 ± 14 s) and Non-Advanced (17 ± 3 rep; 60 ± 0 s). There was difference ($p < 0.05$) in maximum static lift test between Recreational (43 ± 5 s) and Beginners (28 ± 9), but not in maximum number of repetitions test between Recreational (9 ± 3 rep) and Beginners (7 ± 3) respectively. Moreover, we observed differences ($p > 0.05$) between both tests in the Recreational and Beginners groups compared with Advanced and Non-Advanced groups.

Conclusions. We conclude that isometric kimono grip pull-up test is able to discriminate isometric strength endurance between 4 different levels of Brazilian Jiu-Jitsu players groups, but dynamic kimono grip pull-up test only discriminate strength endurance with larger differences concerning practice levels.

Introduction

Brazilian Jiu-Jitsu - BJJ is a grappling sport characterized by high-intensity intermittent effort separated by low-intensity periods [1,2]. The match duration in the official championship for adults graded from blue belt is 5 min, purple belt 7 min, brown belt 8 min and black belt 10 min [3,4]. It is very similar to judo and wrestling in many aspects, although there are differences in these styles generally involving gripping, throwing, ground grappling, chokeholds, and joint locks [5].

In combat sports involving grappling, muscular strength is considered one of the most important physical components to be developed, through dynamic and static actions, specifically in upper limbs [5-8]. Such strength manifestations are vital

in BJJ performance [5,8], specially to maintain the grip and to control the opponent, to perform new attacks, and defenses or counter-attack actions [8,10].

As a mechanism to evaluate the muscular strength *kimono* grip pull-up test (KPU) has been considered a useful instrument to indicate dynamic muscular endurance in judo [13] and BJJ [10]. Studies [10,13] have confirmed the effectiveness of this method to discriminate muscle strength in upper limbs of athletes from different competitive levels, Franchini et al. [13] with judo athletes and recent work performed from our laboratory evaluating BJJ athletes [10]. Additionally, the isometric version has been used successfully to evaluate the impact of a typical BJJ training session on isometric strength endurance [14].

Although previous researches [10,13,14] have investigated KPU tests no other investigative studies compared KPU tests between more than two differently groups of BJJ athletes. We believe that the knowledge about physical profile of BJJ players will help athletes, coaches, and conditioning specialists to establish a guideline for training programs to improve athlete performance. Therefore, this study aimed at compare maximal static lift (MSL) and maximal number of repetitions (MNR) between 4 different levels of BJJ players. We hypothesized that these tests could properly differentiate BJJ athletes from different levels.

Material and methods

Forty BJJ male players participated voluntarily and were subdivided in four groups: a) 10 Advanced athletes (AD); b) 10 Non-advanced athletes (NA); c) 10 recreational (R) and d) 10 beginner practitioners (B). The following criteria were considered to include the subjects at the moment the study was conducted: a) to present age between 20 and 38 years; b) to be at least 3 month of experience in BJJ; c) to be training from 3 to 18 h per week, d) not to present any physical limitations to the tests; e) not being using nutritional supplements or potential ergogenic aids of any kind; (f) being familiarized with the exercises. The criteria to be include in each group were: a) Advanced – to be graduated as brown or black belt, and medalist at state, national or international competitions; Non-Advanced – to be graduated as blue or purple belt and medalist at state, national or international competitions; c) Recreational – to be graduated from blue to black belt and occasionally participate in competitions; d) Beginners - to be graduate as white belt and to be at maximum 1 year of experience in BJJ. This study was approved by local Ethics Committee and was performed in accordance with the Helsinki Declaration of 1975, as revised in 2008. Prior the study the volunteers signed an informed consent form.

The physical, strength and BJJ training characteristics of the 40 subjects who completed the study are shown in Table 1.

Procedures

This study was performed during pre-competitive period for G and NG players. All participants undertook familiarization with tests, including theoretical instructions and anthropometric measurements. The reliability for both tests was

assessed in a previous study, which reported an intraclass correlation coefficient (ICC) > 0.9 and a confidence interval 95% inferior/superior limits of 0.927/0.989 and 0.966/0.995 for both tests. Both in the familiarization and in the days of the tests the participants were instructed to arrive at the gym in a rested and fully hydrated state, at least 4-hr postprandial, and to avoid strenuous exercise in the previous 24h. Each subject was tested at the same period of the day (16:00 h - 18:00 h) in a room with constant temperature (23 °C).

Measures

Maximum static lift (MSL)

The participants cycled 5-min on a stationary bicycle (Monark®, 60 rpm, 25 Watts). Following this warm-up, they did two sets of 5-s of grip holding on *kimono* rolled around the bar, with the elbow joint in maximal flexion, and 1-min of pause between the sets. After 3-min (passive pause), the BJJ athletes were required to sustain this position during the maximal possible time.

Maximum number of repetitions (MNR)

Fifteen minutes after the MSL test, the participants undertook the MNR. Before, however, they cycled 3-min and did two sets of five repetitions with 1-min break. Following 3-min of passive pause, the volunteers performed the MNR from a fully flexed to a fully extended elbow position, with the same grip position applied at MSL.

Statistical analysis

The normality of the data was tested by Kolmogorov-Smirnov test. A One Way analysis of variance (ANOVA) was used to determine whether differences existed between the groups for physical and training characteristics and for MSL and MNR tests. Tukey post hoc test were used to determine where those differences existed. Statistical significance was accepted at an alpha level of $p \leq 0.05$. Effects size were assessed using partial eta squared (η^2). Statistical Package for Social Sciences 17.0 (SPSS Inc., Chicago, USA) was used to perform analyses.

Results

Figure 1 and 2 present results in absolute values of *kimono* grip pull-up test (KPU) dynamic and isometric to evaluate endurance strength from G, NG, R and B groups.

Tab. 1. Age, body mass and height of BJJ players (n = 40) from different levels

Variables	Advanced (AD)	Non-advanced (NA)	Recreational (R)	Beginners (B)
Age (years)	26.3±3.8	23±4.7	29.8±5.7	30.3±5.8
Body mass (kg)	76.7±8.5	78.6±6.7	79.7±9.6	77.8±11.5
Height (m)	1.77±0.03	1.78±0.06	1.79±0.05	1.74±0.06
ST (years)	6.6±3.6	4.6±2.	8.1±4.5	3.3±1.4
NSBJJ (sessions/week)	10.4±1.9 ^a	9.2±1.8 ^b	3.8±1.9	2.5±0.5
BJJ practice (years)	9.5±1.7 ^c	4.3±1.8 ^d	7.7±6.3	0.4±0.2

ST = strength training; NSBJJ = number of session Brazilian Jiu-jitsu; BJJ practice time = time of practice BJJ; AD = advanced; NA = non-advanced; R = recreational; B = Beginners

^a= AD different from R and B; ^b= NA different from R and B; ^c= AD different from NA and B; ^d= NA different from AD, R and B; ($p < 0.05$).

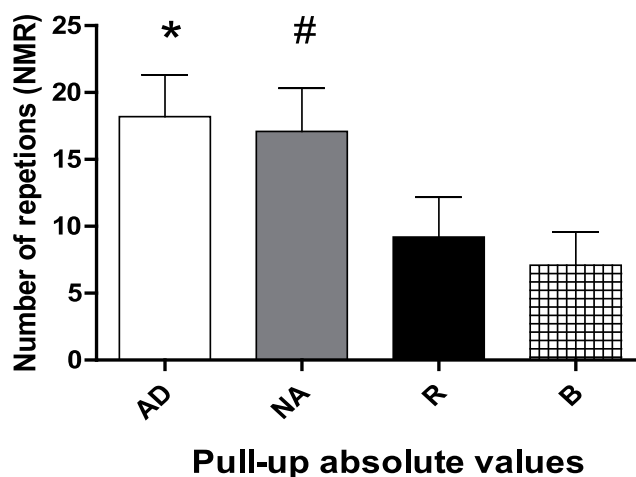


Fig. 1. Maximal number of repetitions performed by advanced (AD), non-Advanced (NA), recreational (R) and beginners (B) BJJ athletes. * = AD different from R and B. ($P < 0.05$); # = NA different from R and B. ($P < 0.05$)

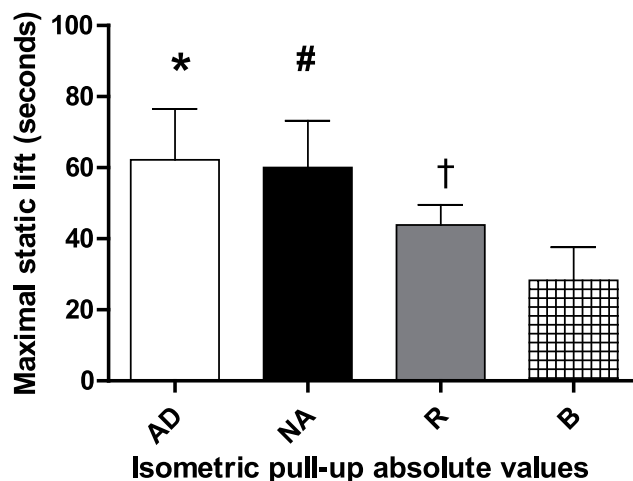


Fig. 2. Maximal static lift performed by advanced (AD), non-Advanced (NA), recreational (R) and beginners (B) BJJ athletes. * = AD different from R and B ($P < 0.05$); # = NA different from R and B ($P < 0.05$); † = R different from B ($P < 0.05$)

For the dynamic test there was a significant effect of group ($F = 35, 45$; $P = 0.001$; effect size = 0.747) on number of repetitions. Advanced athletes presented higher performance compared to recreational ($P = 0.001$) and beginners groups ($P = 0.001$). Non-advanced athletes also were superior to recreational ($P = 0.001$) and beginners groups ($P = 0.001$).

There was also a significant effect of group ($F = 20, 13$; $P = 0.001$; effect size = 0.627) on time of suspension in the isometric test. Advanced athletes presented higher performance compared to recreational ($P = 0.004$) and beginners groups ($P = 0.001$). Non-advanced athletes also were superior to recreational ($P = 0.014$) and beginners groups ($P = 0.001$) and recreational were superior to beginners ($P = 0.017$).

Discussion

We compared maximal static lift (MSL) and maximal number of repetitions (MNR) between 4 different levels of BJJ players. The main results obtained in MSL and MNR from this study were: a) in both tests, the AD presented a better performance compared with R and B groups; b) in both tests, the NA performance was significantly better than R and B groups; c) in both tests, there were no differences between AD and NA. Besides, in MSL test the R group performed better performance than B group.

The results from this study revealed similarity to recent works based on KPU tests to differentiate combat sports' athletes [10,13], as verified in MNR test by Franchini et al. with judokas athletes [13] and Silva et al. with BJJ players [10]. The

AD athletes studied in the current work performed a slightly higher number of repetitions in the MNR (18 ± 3 rep) compared to elite BJJ athletes (15 ± 4 rep) [10] and a higher number compared to judokas [13] (12 ± 5 rep). However, recreational (9 ± 3 rep) and beginners BJJ players (7 ± 3 rep) from our study had very close performance compared to non-elite BJJ athletes from Silva et al. study [10] (8 ± 3 reps), recreational had similar values and beginners slightly lower to state level judokas (9 ± 4 rep). Concerning the isometric strength endurance time, the results presented by the athletes groups in our study are quite similar to those reported by Santos et al. in the control condition from their study [14]. Our results indicate that PUK tests are a discriminatory element of isometric and dynamic strength endurance between groups (athletes versus non athletes).

From a BJJ training perspective, KPU tests demonstrated to be important because during the period of combat both athletes try to throw, sweep or restrain the opponent repeatedly by holding the *kimono* of the adversary. Generally, these actions are performed with isometric and/or dynamic actions flexing the elbow joint to reduce the distance from the opponent. Thus, differences in the strengths endurance, in order to perform effectively these movements during the match, could influence BJJ performance. Even though others studies [8, 12] assessed maximal and endurance grip by handgrip dynamometer, this measure represents only one component of what happens in a fight. Although the region of forearm is active to perform isometric action, the trunk and arm are normally executing dynamic actions.

Differently, during KPU tests, forearms perform isometric action while arms are executing dynamic actions. Additionally, as these tests involve sustentation of athletes own body mass, they guarantee a direct relation to the weight category [13].

Our study was able, as well as the previous studies [10, 13], to discriminate groups from different competitive/practice level. In recent investigation [9], differently from the study applied to the judo athlete [13], the BJJ athlete groups were composed by subjects from blue to black belt. Therefore further investigations using athletes with the similar graduation levels are required, since in some BJJ official championships the athletes are subdivided in blue to purple belt and from brown to black belt groups.

In the present study it was observed significant differences among dynamic KPU test only when athletes (AD and NA)

were compared to non-athletes (R and B) groups. Although we cannot affirm the specific reasons of these differences, it seems that dynamic KPU test was not able to discriminate subjects who are involved with competition, independently of graduation level. Furthermore, our findings appear to indicate that other factors, more than time of practice, could induce better response during dynamic KPU test. Regarding the results observed, perhaps the number of training sessions (NST) performed for each group could account partially by the difference in results. We can emphasize that one of limitations of this study was not to estimate the body fat mass percentage, which could interfere with performance in these tests.

Considering the data from literature about KPU [10,13,14] tests and the vital importance of dynamic and isometric strength endurance for BJJ performance[10], we indicate their applications not only as a mean to discriminate strength level between subjects from different competitive levels, but to analyze strength evaluation in BJJ players and to be guideline for training programs that will improve performance. Additionally, we suggest the need for more investigations into the application of KPU in aiding athletic performance for BJJ, because the direct relationship between KPU tests and the fight results is not entirely clear at this time.

Conclusions

We compare maximal static lift (MSL) and maximal number of repetitions (MNR) between 4 different levels of BJJ players and this study concluded that only isometric KPU test is able to discriminate isometric strength endurance between groups. However dynamic KPU test discriminate strength endurance with larger differences concerning practice levels (AD and NA versus R and B). Together with previously published data from the same test seem that isometric KPU test can be used for the physical evaluation of Brazilian Jiu-Jitsu from different levels because they are highly specific and accessible.

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